ganic salt relations of plants, and relation of plants to climatic conditions. A quotation from the book expresses the point of view under which the work of the laboratory is being conducted.

To summarize the last few paragraphs, our operations have been and are directed toward a dynamic analysis of plant activity. The point of view here employed may perhaps be envisaged if the reader will regard the living plant in somewhat the same general way as he might any complex machine, such as a gasoline motor, for example. To understand its working, one must understand how and how much various conditions may effect a machine; in short, he must become an engineer with respect to that particular mechanism. Dynamic plant physiology may be said, then, to be engineering science as applied to the living plant. It can progress, then, only through quantitative studies, through the comparison of efficiency graphs and curve-tracings made by recording instruments, through the mathematical interpretation of relations between conditions and process rates, etc., and it is with just this sort of studies that our investigations have to do.

It might be well if scientific departments generally issued such statements of their aims and progress.—Wm. Crocker.

NOTES FOR STUDENTS

Rhizoctonia.—In a paper constituting a continuation of former studies of the genus *Rhizoctonia*, Eriksson[2] adds an account of two further forms, *R. Medicaginis* DC. and *R. Asparagi* Fuckel. The paper deals largely with historical and descriptive matter; the chief interest, however, centers in the questions relating to the taxonomy and morphology of these fungi. In 1851 the Tulasne brothers united *R. crocorum* DC., *R. Medicaginis*, and most of the forms of *Rhizoctonia* occurring on other hosts under one species, which they called *R. violacea* Tul. Eriksson, basing his judgment partly upon the association of *Leptosphaeria circinans* (Fuckel) Sacc. with *R. Medicaginis* reported in the literature and also observed by him, and partly on the resemblance of the hyphae of the germinating spores of *Leptosphaeria* to the mycelium of *Rhizoctonia*, concludes that *Rhizoctonia Medicaginis* has an ascogenous fruiting stage and therefore is distinct from *R. violacea*, which he had doubtfully associated with *Hypochnus violaceus* (Tul.) Erikss. Regarding the specificity of *R. Asparagi*, Eriksson concludes, as a result of cross-infection experiments conducted by means of infected soil in deep concrete frames, that this fungus is probably a distinct form whose position cannot be determined until something is known of the perfect stage.

Duggar,[3] in a paper published almost simultaneously with that of Eriksson, confirms the view of the brothers Tulasne that all the forms of the violet

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[2] Eriksson, J., Fortgesetzte Studien über *Rhizoctonia violacea* DC. Arkiv. Bot. 12:1–31. 1915.

[3] Duggar, B. M., *Rhizoctonia crocorum* (Pers.) DC. and *R. Solani* Kühn (*Corticium vagum* B. and C.), with notes on other species. Ann. Mo. Bot. Gard. 1:403–458. 1915.

root-felt fungus found on crocus, alfalfa, and many other hosts (of which 54 are listed by him) belong to a single species, to which the name *Rhizoctonia crocorum* (Pers.) DC. must be applied as long as the fruiting stage remains unknown. This view is based upon a critical examination of the data in the literature and an extensive study of living material and herbarium specimens. He regards the evidence thus far presented as insufficient for the identification of the perfect stage of the fungus. Unlike ERIKSSON, he finds no resemblance between the mycelium produced by spores of *Leptosphaeria circinans* which he germinated and the hyphae of *R. crocorum*. DUGGAR further gives an account of *Rhizoctonia Solani* Kühn, which is the more common of the two species in America where it is the widespread cause of "damping off" of seedlings and cuttings and root-rot of various crops. This species is clearly differentiated from the violet *Rhizoctonia* by characteristics of the mycelium and the sclerotia, as well as by the effects produced on the host plants. Furthermore, evidence seems to be sufficient that the perfect stage of this organism is *Corticium vagum* B. and C. In a later paper,[4] as a result of a study of the data in the literature, this fungus is identified with the "Vermehrungspilz" common in the seed beds and cutting beds of Germany and France, and also with the "Mopopilz," causing considerable damage to the seed beds of cinchona in Java. The failure to recognize *Rhizoctonia Solani* as the general cause of the "damping off" of seedlings in Germany and France, as well as in Java, is attributable to wrong determinations of the European seed bed fungus and the cinchona fungus of Java.

Among other differences mentioned by DUGGAR between *Rhizoctonia Solani* and *R. crocorum* is the difference in their capacity for growing on artificial media. *Rhizoctonia Solani* grows readily on all the common culture media, while *R. crocorum* had not, up to that time, been successfully grown. Recently, however, DIEHL[5] reports successful cultures of the fungus from detached masses of mycelium. The fungus grew with extreme slowness, and only in one instance was a pure culture obtained.

A thorough and comprehensive study of the parasitic Rhizoctonias of the United States has been reported by PELTIER.[6] The chief features of the report are (1) a general historical account, (2) a discussion of the morphology of the fungi, (3) a complete tabulation of the data relating to the hosts, occurrence, and distribution of *R. Solani* and *R. crocorum* in the United States, with notes on the distribution of these organisms in other countries, (4) a description of the disease induced by these fungi in different plants, (5) the results of

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[4] DUGGAR, B. M., *Rhizoctonia Solani* in relation to the "Mopopilz" and the "Vermehrungspilz." Ann. Mo. Bot. Gard. **3**:1–10. 1916.

[5] DIEHL, W. W., Notes on an artificial culture of *Rhizoctonia crocorum*. Phytopathology **6**:336–340. 1916.

[6] PELTIER, G. L., Parasitic Rhizoctonias in America. Univ. Ill. Agric. Exp. Sta. Bull. **189**:279–390. *figs.* 23. 1916.

cross-infection experiments with *R. Solani*, and (6) a description of the growth of this fungus in various media.

The numerous cross-infection experiments carried out with *Rhizoctonia Solani* are of special interest. Strains of the fungus from some 30 species of plants were used to infect carnations in several stages of growth, from the cutting to the mature plant, both under glass and in the field. A number of other plants also were infected with various strains of *Rhizoctonia*. The results of all these cross-infection experiments can best be stated in the author's own words: "From these inoculation experiments with a large number of different types of plants, we must conclude that all the strains studied, which were obtained from a wide range of hosts of diverse geographical origin, can attack the same species of plant and produce the same characteristic symptoms. No marked specialization was noted in any of the strains. Thus, all the strains studied can be included under one form, *Rhizoctonia Solani* Kühn. The inoculation experiments show further that the virulence of *R. Solani* is very variable, as is also the degree of resistance of the various host plants, both depending upon a number of factors." A study of the growth characteristics confirmed this general conclusion. Strains isolated from the same host species showed differences as great as those between strains isolated from different species.

MATZ[7] has described a form of *Rhizoctonia* occurring on the leaves and stems of *Ficus Carica* at Gainesville, Florida. This form is regarded by him as a distinct species, *R. microsclerotia* Matz. Aside from its foliicolous habit, it does not appear to differ essentially from *R. Solani*, which MATZ found was also capable of infecting fig leaves, without producing sclerotia, however. In a single experiment the fig fungus failed to infect seedlings of the cowpea, while *R. Solani* killed 90 per cent of the young plants.—H. HASSELBRING.

The number of chromosomes.—Partial lists of the number of chromosomes reported by various observers for various plants have been published from time to time, but the lists have been incidental and usually no authority has been cited. The most complete of these earlier lists is that of TISCHLER (Progressus Rei Botanicae **5**:164–284. 1915). ISHIKAWA[8] has compiled the most complete list ever published, and in each case has cited the authority. Besides, he has counted the chromosomes in several forms which are here reported for the first time. The theoretical interpretation of chromosomes and their value in phylogenetic studies will be considered later. In sexual forms, the x and $2x$ numbers are cited in separate columns; in asexual forms, the numbers are cited in the x column.

A mere glance at ISHIKAWA's tables reveals some interesting facts. In the Flagellates most of the numbers are preceded by the sign $\pm$, indicating an

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[7] MATZ, J., A *Rhizoctonia* of the fig. Phytopathology **7**:110–117. 1917.

[8] ISHIKAWA, M., A list of the number of chromosomes. Bot. Mag. Tokyo **30**: 404–448. *figs.* 32. 1916.